

from the author. 23 13
EXPERIMENTS

AND

Observations

ON THE DANGER OF

COPPER and BELL-METAL

IN

Pharmaceutical and Chemical Preparations:

BY

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Prodesse quàm conspici.

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P R E F A C E.

WHETHER mankind be obedient to the dictates of
 NATURE only, or whether they pay deference to
 the divine precepts of CHRISTIANITY, they will still learn
 that the great duty of man is, *to do all the good he can to his
 fellow-creatures*. Nor are there many without some sense of
 this duty; without feeling some degree of impulse to be
 useful. But various causes operate against the exercise of
 beneficence. RELIGION appears in all its beauty as pro-
 viding against these causes: among the most prevalent of
 which stands PRIDE. — Who, of the learned and the
 great, would choose a *bell-metal mortar* for his theme?
 Yet the value of every work should be estimated by its
 usefulness to mankind; and *utility* will ever reflect *dignity*
 on any subject.

The importance of the following remarks will appear from considerations of the value of health and life. They were written about seventeen years since, and were six years ago sent to the learned Dr. DUNCAN, at Edinburgh, who allotted them the honour of a place in the 7th vol. of his valuable *Medical Commentaries*. The principal evil exposed in them still exists: this justifies the present form of publication; for which the alterations and additions might be offered as an apology.

Lime-street, June 24, 1786.

EXPERIMENTS

E X P E R I M E N T S

A N D

O B S E R V A T I O N S, &c.

PHYSICIANS have been long acquainted with the dangerous quality of copper ; and have of late years humanely condemned the use of copper vessels in culinary preparations. Is it not then strange, although they well understand the pernicious effects of this metal, and even provide against them in the department of the cook, they should yet suffer the shops of apothecaries and laboratories of chemists to abound with copper and bell-metal utensils ?*

A 3

Bell-metal

* The notoriety of the mischievous effects of **COPPER** precludes the necessity of adducing instances.—To describe the *symptoms*, &c. of a baneful dose would be unnecessary to the medical reader, and of no use to others,

unless

Bell-metal may be ranked with copper, in regard to its consequences in the body, since the proportion of this metal in its composition is, I am informed, as two to three. It appears also, from the following experiments, that bell-metal is soluble in nearly the same *menstrua* with copper. The inferences, therefore, deducible from considerations of the danger of the one, must hold good in respect of the other.

I.

Five grains of the filings of a common bell-metal mortar were put to half an ounce of river-water, with half a dram of marine salt. Five grains of the filings of a halfpenny were added to the same quantity of the like mixture.

II.

Five grains of the filings of bell-metal were added to half an ounce of distilled vinegar ; five grains of a halfpenny were put to an equal quantity of the same fluid.

III.

unless the treatment also were explained ; all which is foreign to the design of this little paper ; the simple object of which is, to prove that copper and bell-metal utensils may impart their metallic quality to medicines ; the general hurtful tendency of that quality is received as a *datum*.

III.

Five grains of the filings of the two metals were put to half an ounce of common vinegar.*

The phials, containing the above, were examined after a few days, and appearances were as follow ; viz.

The mixtures marked

No. I. were as blue as *aqua sapphirina* diluted with about an equal part of water, and the two phials were as equally so as the eye could determine.

No. II. were strongly, and about equally, tinted between a blue and green, but not so deeply as No. I.

No. III. had a greenish tint ; but that with copper was stronger than the one of bell-metal.

The danger which may result from the use of copper vessels, in preparations of the kitchen, is not comparable with that which is to be dreaded from them in those of the chemist or apothecary ; since, in the first case, excepting salt and

* Salt and vinegar were used because culinary as well as pharmaceutical articles.

and vinegar, few articles of a very corroding nature are subject to the treatment of the cook ; whereas, to the apothecary belongs the management of materials of every quality. Besides, a person in health is less liable to feel the effects of what is baneful than a valetudinarian, whose organs are weak, and readily thrown into disorder. The following circumstances gave rise to these reflections and experiments.

Some *coralium rubrum* was powdered in a bell-metal mortar, sifted, and levigated, after the manner of treating such like articles of the *Materia Medica*. The operator then proceeded to the washing of it, as it is termed, *i. e.* the separating of the fine from the coarse by ablutions with water. In this process, he applied some of the coral to his tongue, to ascertain its degree of tenuity, and thought he discovered a flavour of copper ; but the existence of this metal in the mass was presently confirmed by the appearance of some particles of the mortar among the coarse coral remaining in the vessel, which, upon its detachment, proved to be pretty considerable in quantity.

Left it should be alleged that the mortar, wherein the coral was powdered, was of a peculiar composition, it
may

may be proper to remark, that, upon the fairest comparisons, it appeared to be of the like kind with other bell-metal mortars.

From these circumstances, may we not justly apprehend that many of the triturated preparations are impregnated with copper? But we will consider other alarming facts that prove this suspicion to be too well founded.

To determine whether they were really particles of metal that appeared with the coarse coral, the following experiments were made.

EXPERIMENT I.

The particles, separated from the coral, appearing like copper, and weighing about four or five grains, were put to two drams of *spiritus salis ammoniaci*; a high sapphirine colour presently took place, which increased in depth till the particles were dissolved.

EXPERIMENT II.

A few grains of the filings of the mortar were put to two drams of *spiritus salis ammoniaci*; a sapphirine colour, as in the preceding experiment, was soon produced.

B EXPERIMENT

E X P E R I M E N T I I I .

A few grains of verdegris were added to two drams of *spiritus salis ammoniaci*; a fine blue colour was directly obtained, similar to that in the former experiment.

Do not these experiments amount to a proof of the existence of copper among the coral?

If particles, as large as grains of sand, were deposited with the coarse coral, as was the case, we may conclude that much smaller ones, not discoverable by the naked eye, remained suspended with the fine; for extension of the surfaces of bodies will enable them to swim in fluids specifically lighter than themselves.

The subsequent experiment evinced this fact.

E X P E R I M E N T I V .

One dram of the prepared coral, with two of *spiritus salis ammoniaci*, presently exhibited a blue appearance; which, though not by much so deep as the solution, Experiment I. was yet as high as any *aqua sapphirina* I ever saw.

These experiments were so satisfactory to the apothecary, under whose inspection they were made, that he instantly

ly

ly ordered iron mortars to be procured, in place of bell-metal, proved to be dangerous.

I took one drām of the prepared coral, and it excited a slight degree of nausea. But be it remembered, that the physician prescribes for the sick, and those unable to combat with any powerful stimulus. And is it not an alarming consideration, that what is intended as a pacific remedy may prove an auxiliary to a disease already hard to be sustained? This, it is to be feared, must be the case, when coral, or other absorbents, which have undergone trituration in bell-metal mortars, are given in *diarrhæas*, or to check violent vomiting, or in bowel-complaints of children. The cupreous impregnation, which these powders, thus prepared, may acquire, cannot but prove a most dangerous stimulus to the stomach and intestines in an inflamed, tender, or abraded state.*

B 2

But,

* A man spends the greater part of his life in learning the æconomy of the human body, under the various circumstances of health and disease: he then professes to exercise his knowledge for the relief of his fellow-creatures, — is called to the sick, — meditates upon their complaints, — and conscientiously prescribes medicine for them. But why all this study and labour, if regard be not had to the *truth* and *faithfulness* of the means prescribed!

But, if the evil be not general, conclusions of a general nature would be improper ; the universality of it then is next to be considered. But no one will deny the universal *use* of bell-metal mortars. The inquiry therefore rests, Whether the mortars of others are equally susceptible of abrasion with that in the above instance ?

I procured prepared coral from several apothecaries ; some afforded a bluish tincture in the *volatile alkali* ; other a yellow colour. Some crabs claws gave the same kind of yellow tinge ; other crabs claws imparted a greenish tincture. Powder of hartshorn, which I had from different apothecaries, afforded a light blue tint in spirit of *sal ammoniac*.*

If we admit the inferences from the first and second experiments, we may conclude, that the blue colour in the subsequent ones was derived from copper. What occasioned the yellow tinge from some of the coral I cannot say ; but this I must observe, that the coral which gave it had not the marks of being genuine.† The green in the
chelæ

* Burnt hartshorn can hardly be brought in contact with bell-metal without receiving a cupreous taint.

† Would it not be just to annex fines, or even corporal punishment, to the crime of adulteration of medicines ? The butcher and baker ought to be held

in

chelaæ cancrorum was but little remote from the blue in the other experiments.

The

in proper subjection, lest our common articles of food should be unwholesome. But it is unimportant whether a man be poisoned by a slice of bread or a dose of physic.—The *druggist-apothecaries*, now to be found in almost every street, *who make up prescriptions on very low terms*, require the strictest attention. A desire of gain is, at all times, too apt to efface sentiments of honour and the finer feelings of humanity; but, when it can be gratified by fraud, without hardly a chance of detection, many, it is to be feared, want VIRTUE to resist its force. Nor are the effects of IGNORANCE among the *druggist-apothecaries* to be overlooked. I remember a dreadful mistake of one of these persons about twelve years since. A physician directed some *sal rupeil.* to be dissolved in water for a young lady. The compounder said “he supposed *sal, &c.* meant *alumen rupeum*,” which he employed: the child died. These circumstances were not learnt till too late. ——— Why do not the three branches of the profession unite in forming a committee of inquiry into *all* the irregularities practised in the profession? The safety of the public, (the end for which they were respectively incorporated,) demands it. The legislature would, undoubtedly, in their wisdom, support measures calculated to preserve the lives, health, and happiness, of the community.

The laboratories of chemists are subject to the inspection of the members of the College of Physicians. But the sinister practices of chemists can hardly be discovered *but by examinations into their PROCESSES*. Most of the country practitioners, many of the country hospitals, and some of the large hospitals in these cities, are supplied with chemical preparations from chemists in London. Surely the magnitude and extent of the evils, that may flow from this source, demand as much attention as the adulteration of wines, or any other article of luxury.

The adhering membrane in crabs claws gives a yellow tincture.

From what has appeared, it cannot be doubted that bell-metal mortars are liable to be abraded by hard substances powdered in them. If any one should dispute the fact, let him rub some powder of burnt hartshorn, coral, or crabs claws, in a bell-metal mortar, and afterwards try it by a proper criterion, (the best, I suppose, is the *volatile alkali*,) and he must certainly admit the truth of what has been remarked.

If the above facts, and inferences from them, should be admitted, the necessity of an immediate regulation in the chests of army and navy surgeons will appear in a very striking light; for, army and navy medicine-chests are constantly supplied with bell-metal mortars, and with no other of metal.

But it is probable that what has been advanced may be disregarded, because generally known. The *importance* of the observations none can deny. Their being admitted implies shameful supineness in those whose duty it is to inquire into such matters, since the evil complained of is not corrected.†

To

† Subterfuges for this omission may be attempted. — The sanction of *time* may be pleaded in defence of the practice arraigned; but this can have little weight

To determine whether a blue colour would succeed on digesting the unpulverized ingredients in the *volatile alkali*, I put some coral, crabs claws, &c. broken in pieces, into spirit of *sal ammoniac*, and, after suffering them to digest many days, examined the spirit, and found it limpid and colourless, excepting a yellowish cast in that with the crabs claws, which was undoubtedly from the adherent membrane, as already hinted.

There is a difficulty in discovering copper, in many drugs, on account of the colour they impart to *menstrua*, by which the test becomes obscure ; but reason teaches us, that all hard substances are liable, through attrition, to abraze bell-metal, whereby they will become laden with metallic particles. Admit, however, the *possibility* of this effect taking place, is it not a distressing reflection, that we may *possibly* be giving POISON while we rest secure in the administration of medicines in themselves harmless ?

I have hitherto considered bell-metal mortars as subject to *abrasion* only ; but they may impart a poisonous quality to weight against the force of *reason* and *experience*. A *doubt* of its dangerous tendency may be started ; but the sceptical would be loth, I conceive, to have their doubts removed either in their own persons or those of their children. Let such, too, take care, lest the dignity of medicine be hurt by shewing the difficulty

to medicines on the principle of *corrosion*: thus, for instance, if you rub powder of burnt hartshorn ever so little, or, even, let it lie some time in a bell-metal mortar, an obvious blackness will succeed, especially if it be moistened with any liquor.

There can hardly be a doubt that *pulvis ari compositus*, *pulvis è scammonio compositus*, *pulvis è sena compositus*, *pilulæ ecphrasticæ*, *pilulæ saponacæ*, and other alkaline and acid preparations are frequently made in bell-metal mortars, as they only are in general use, and at hand on all occasions. I will not here make a comment. Let candour acknowledge, let humanity express, what must be the consequence of this procedure. Suffer not, then, such dangerous instruments to be seen in shops, that should be the repositories of friendly medicines, prepared with conscientious care.*

Having

difficulty of obtaining *positive* proof of many medicinal effects.—That all things called **POISONS** are *relatively* poisonous will be readily allowed; but this consideration strengthens every argument in support of the most cautious and circumspect conduct.

* The learned members of the College of Physicians, now engaged in a revival of their *Pharmacopeia*, are respectfully called upon to pay attention to the **FACTS** contained in this paper.

Having upon facts condemned *bell-metal*, it will be required, What other kind of mortars will answer the purposes of apothecaries and chemists? The reply is ready; IRON. The experience of several gentlemen has proved that mortars of this metal answer perfectly well. It may be objected, that iron is apt to contract rust. But let me observe, that attention to the foulness of bell-metal and brass, is more necessary than to that of iron, as neglect in the one case would be excessively dangerous, in the other hardly more than an inelegant omission. But cast iron is really less susceptible of the impressions of the air than bell-metal. In all respects it has the advantage of it, and is beyond comparison cheaper.*

IRON then, a perfectly innocent metal, should be the substitute to one of allowed virulence.† And what solid objection can prevent the regulation from immediately tak-

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king

* The Committee of the LONDON HOSPITAL have ordered iron mortars to be purchased for the use of their laboratory and dispensary, and their present bell-metal ones to be sold, from a representation of the facts in these pages.

† There is a wide difference between the judiciously-appropriated use of any thing endued with great medicinal power, and the uncertain and indiscriminate application of the same thing.—To make amends, in some measure,

king place? The uneasiness that ever attends an uncertain practice should be a powerful incentive to apothecaries to make the reform. The satisfaction arising from being assuredly on the safe side, would, to feeling minds, be a sufficient reward.

But the evil stated is not the only one of the kind. Copper or brass PANS, &c. ought never to be used in preparing of medicines. Yet it is to be feared that *electarium à cassia*, and *electarium lenitivum*, the extracts, and syrups, are frequently prepared in copper vessels; and, sometimes, possibly, *rob baccarum sambuci*, *extractum cicutæ*, and the syrups of acescent fruits. Is *tartarum emeticum* ever boiled in copper vessels? I lately saw some *unguentum album* of a greenish colour; and, inquiring into the reason of this appearance, was candidly informed, it had arisen from being made in a copper pan.

Let

sure, for the hard expressions used against copper, I shall observe, that *vitriolum cæruleum* has been long experienced to be a noble tonic medicine. There are many cases which require the most powerfully tonic means, in which, at the same time, *cortex Peruvianus* is, for various reasons, inadmissible. In such, this medicine has been found of the greatest service. It seems also to assist the urinary secretion, and the functions of the absorbent system.

Let the operator take care lest he fall into another evil, I have heard an able physician say “ he was fearful of ordering *oxymel*, lest it should have been boiled in a *glased* vessel, and his patient should unfortunately take *lead* in solution in vegetable acid.”

IRON and TIN might, it is imagined, on every occasion be *safely* employed. PEWTER must, in some instances, be hazardous ; for it consists, I am informed, of tin and *antimony* ; and regulus of *antimony*, in solution in acids, constitutes a powerful preparation ; hence *tartarum emeticum*, &c.*

But a field of speculation of danger opens upon me, which I shall leave to others, of more abilities, to investigate ; whose province it more particularly is ; and who may have power to correct the evils investigated.

* The PEWTER, of which many utensils are made, such as the worm, and other parts, of stills ; wine measures ; apothecaries measures ; ordinary spoons ; &c. is reduced with LEAD. This was first suggested to me by an experiment with some *juice of lemon*, which had been a while in a pewter vessel ; and has been since satisfactorily confirmed by a candid and humane manufacturer.—Who can reflect on the powerful effects of lead, when dissolved in vegetable acid, and not be stricken forcibly with the danger that may arise from the incautious use of many pewter articles !

F I N I S.

